SUPPLEMENT.

The Mining Journal,

RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

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THE SHROPSHIRE COAL FIELD—No. IX.

FORMATION AND DENUDATION OF STRATA.

SIR,—We have shown that after a hundred distinct sets of strata of the lower group of coal measures had been laid an interval occurred, during which the work of deposition was suspended, and that of denudation set in. New surfaces were given to pre-existing rocks, and other strata were laid on the eroded sheets of the older coal measures, the two bearing that relation to each other which geologists express by the term unconformability. Two groups of rocks in such relation to each other is an indication of an interval having elapsed, during which one had been disturbed, and the other formed, often out of the ruins. Thus, those broad black minerals sheets forming our present coal measures having first been spread over hundreds of square miles were afterwards torn and wasted; the work of destruction then ceased, whether suddenly or otherwise we cannot say, and those old red sandstone lands on the south, whose soils served to support the older coal measure flora, once more dipped beneath the waters to receive in turn their share of vegetable spoil. Excepting on a few palæozoic islets, which may have peered here and there above the waters, the upper coal measures were now deposited along extensive tracts intermediate between the South Wales and Forest of Dean coal fields—measures which include those of Linley, Tasley, Kinlet, Stanley, Dexshill, and others in the direction of Bewdley, also those of Lebotwood, Westbury, and other places near Shrewsbury.

At Westbury, Lebotwood, Chorley, Kinlet, and in Bewdley Forest, some of these are still worked, a few tolerably good seams having been met with. At Billingsby, a Liverpool company built blast furnaces some years ago, and considerable works were formerly carried on, as indicated by the old grass-grown mounds and workmen's cottages, now in ruins. There are usually three seams of coal, the upper one being comparatively useless, the second from 32 in. to 2 ft. thick, and the lower one, which in many cases is very impure, being from 1 ft. 6 in. to 4 ft. in thickness, In some places a fourth seam of coal has been discovered. Between Kinlet Park and High Green, for instance, four seams in the following descending order have been found: Sandstone and shale, thickness variable; first coal, 3 ft.; second coal, sometimes sulphurous, 1 ft. 6 in.; clods and ironstone, 3 ft. 6 in.; and a third coal, which thins out to 1 ft. 6 in.; 4 ft. of shale then occur, and a measure of 2 ft. next conducts to the fourth coal, which is 2 ft. thick. At Chorley, a seam 5 ft. thick of good coal is now being worked; there is altogether about 12 ft. of coal in the shaft, and the same company are working the same coal at Shatterford. At Stanley, two seams of coal were found at a depth of 117 yards, and lower down four other smaller seams. At Dexshill, Dowles, Dumbleton, King's Wood, Holycott, Little Scotland, Baveny, Bayton, Endon, Mamble, Tedstill, Menith Wood, and other places, also, these coals have been found; but the quality of the fuel is very inferior, and most of them contain sulphur to a large amount. Still, they are much sought after for drying hops and burning lime, for which purposes they are said to be as good as those of a sweeter kind. Many persons, laudably desirous of turning to account the resources of the district, or of adding to the value of their own estates, have impoverished themselves greatly by searching for these and other coals of a better kind; and some have been completely ruined by such speculations. Beside the inferior quality of the coal, the beds are in many places so shattered and dislocated as to render the enterprise anything but profitable. These not only rest unconformably on the Old Red Sandstone, but overlap the eroded lower coal measures as they approach them from the south. At Linley, near Apley Park, only two worthless seams of coal are found, accompanied by a band of ocherous limestone, which makes a good cement for setting under water, and which is also quarried at Caughley, where it receives the name of Lord Forester's Livery, for colouring purposes.

The valley of denudation, however, does not appear to have been filled up by these younger members of the coal measure series; hence the Permians come up and overlap the whole, along an undulating line running north and south, parallel with that of the Symon Fault. At several places they may be seen overlying the younger members of the coal measures south of the old coal field; also the latter group where the younger are denuded. It is remarkably instructive, as regards the nature of this fault, that just on the line where the coal seams terminate the Permians make their appearance, rapidly increasing in thickness as one after the other of the former disappear. Thus, about a mile north-west of the Granville, New Stafford, and Kemberton pits no Permians are found, yet at these pits there are 200 or 300 ft., at least; at Sutton Maddock, two miles south-east, there are from 400 to 500 ft., and at Claverly and Enville, still further south-east, they attain the enormous thickness of 1500 ft. At the Hay, near Coalport, and at several points on both banks of the Severn, lower down, good opportunities are afforded for observing both the character of these rocks and the mode of their occurrence in conjunction with the denuded older strata. They consist for the most part of red and yellow sandstones, purple bands of marl and sand, of the usual conglomerates, and of a calcareous limestone, which may be traced pretty much in a line along the eastern side of the coal field to Great Chatwell, a distance of some 15 miles, where it attains its maximum thickness, and is burnt for lime, and where Mr. Boultbe sunk through it at great cost, and also through 565 ft. of Permians, without meeting with any signs of the coal measures. In a tunnel formerly yielding large quantities of tar, driven into the side of the hill a little above the level of the Severn, the approaches of the fault may be seen, whilst on the side of the hill above a hard white sand rock, with intervening conglomerate, occurs; and still higher up a softish bed of yellowish sandstone is seen. The latter is much weathered, exposing the roots and branches of trees which, from the way the former appear to penetrate the sand, would seem to have grown there, or to have been suddenly buried. They are altogether of a different substance to the rock itself, have a white marble appearance, and penetrate through 10 ft. of sandstone. They appear to differ from the lower coal measure plants, excepting in one instance, in which the stem resembles a calamite, but the flutings are imperfect. A dull red sandstone next comes dovetailing in, which soon assumes a body of considerable thickness, and is evidently unconformable with the softer yellowish sandstone below. This splicing of rocks of apparently different ages is still more evident 50 yards to the south, where the upper and newer members have drawn from the older ones, and have been bent in the process. Half a mile still further south similar sandstones again occur, with bands of purple clays below, and a calcareous rock above, capped by well-recognised red Permian rocks. It may be that the soft yellowish sandstones below do not really belong to the Permians so much as to that group of rocks formed by the waters which destroyed the coal measure rocks, of the eroded materials of which they may be composed. One single seam of coal only has been found beneath, and this occurs just below the bed of the Severn, at Swinney. On this, the left bank of the Severn, the soft yellow sandstones alluded to dip at gentle angles, and soon become lost beneath the red and purple rocks which characterise the Permians, and in which, at Apley Park, three miles south-east, a thin seam of Permian coal has been found. Even if this set of Permian rocks had not rested unconformably upon the true coal measures, the fact that 8 per cent. only of the plants found in them can be identified with those of the coal period would be sufficient to show how widely they differ in character and age from the latter.

JOHN RANDALL, F.G.S.

ON ACCIDENTS IN COAL MINES, AND SUGGESTIONS FOR PREVENTING THEM.

SIR,—Several parliamentary enquiries have taken place on the subject of accidents in coal mines, more particularly with reference to explosions, having for their object to elucidate the causes of those calamities which from time to time have occurred in the United Kingdom, and to institute some remedial measures for their prevention. The evidence and the opinions of the most scientific and practical mining engineers and others connected with the management of mines have generally been taken at these enquiries. It is our intention to notice these at a future time, with the exception of the Select Committee of the House of Commons, whose report was issued last year. This Committee was appointed "to enquire into the operation of the Acts for the Regulation and Inspection of Mines, and into the complaints contained in petitions from the miners of Great Britain with reference thereto, which were presented to the House during session 1865." The Committee in their report propose to limit the age at which boys are to be employed underground; they recommend the appointment of stipendiary magistrates, an increase in the number of the Inspectors of Mines, and a division of colliery workings into distinct compartments, each with its own system of ventilation, so that a limited number of men would be exposed at the same time in case of an accident from explosion. A discussion has lately taken place in the House of Commons on the question of accidents in coal mines, of a more practical character, and from that, it is now thought, an amended Act of Parliament will be brought forward next session.

It must be observed that underground operations being more dangerous than above ground industrial pursuits, we must naturally expect some loss of life resulting from them. When we consider that coal is now worked at greater depths and in increased quantity every year, some means it is hoped will be forthcoming to have the mines conducted on safer principles than they are at present. Government and the country have been put in possession of a large amount of information of a reliable and disinterested nature, through the reports of the Inspectors of Coal Mines, which may serve as a guide and basis for future legislation. Their appointment has tended to improve the ventilation and general management of coal mines, but some further protection and safeguard it is evident is still required, and their power to enforce the use of recognised improvements should be increased, as the general loss of life in coal mines shows but little diminution during the period from 1856 to 1866, inclusive, even when compared with the increased quantity of coal got per year, as shown in the table. Some authorities think that their visits to collieries should take place periodically, and the districts should be so arranged and limited that every colliery should be inspected at least once a year, or oftener when any important matter requires extraordinary attention. These visits would, no doubt, have a beneficial and salutary effect, when we consider that many of them are of great practical experience and scientific attainments in their profession, and would, in their inspections, detect anything out of place, in the amount and distribution of air in the workings, the furnace arrangements, and the mode of lighting the mines.

The safety of the colliery must depend on the ability and judgment of the viewer, who is responsible for its being properly planned, laid out, and conducted, and for the general and special rules being strictly enforced; the overman carrying out the orders of the viewer, and, in his absence, assuming the charge of the pit. It is not thought advisable to have any division of authority which the appointment of a great number of sub-Inspectors would, no doubt, occasion. If the latter assume the authority, then the responsibility is removed from the owners of the colliery to the Government, but Government have no wish to do this. Their intention is for the owners of collieries to be responsible for the carrying on of their own works. They appoint their Inspectors as agents, to see that a proper system of management is carried out, and the lives of miners protected, by the use of the most skilful shaft and underground appliances and arrangements.

The great safeguards in collieries producing fire-damp are—1. Good ventilation; this comprehends abundant supply of air properly distributed through the workings, brought to the upcast pit, in case of furnace ventilation, without coming in contact with the fire, and airways of sufficient size. It is highly censurable to take air into a mine and allow it to waste through stoppings, canvass or other doors, leaving the interior parts without sufficient air to dilute and render harmless the gases produced therein; this a prudent manager will avoid.—2. In the use of safety-lamps. It is difficult at all times to draw a line of demarcation as to where safety-lamps should be used or not, but where mines are subject to outbursts of gas, either from the roof falling to a superior coal, or from falls in the goaf behind, or from any other source, there should be no hesitation in using safety-lamps, under strict regulations. In the Yorkshire coal field, the great utility of the Stephenson lamp under these circumstances has been several times proved, the lamps becoming extinguished on the occurrence of these outbursts, and no accident occurred. Passing through an ordeal of this kind argues in favour of their constant use.—3. In the strict enforcement of the colliery rules on the part of the viewer and overman, by which the ventilating and lighting arrangements are to be safely carried out. It is unfortunate that in these matters a very slight error or act of indiscretion may lead to incalculable mischief, such as exposing the light of a safety-lamp, a door being left open, or entering certain places with naked lights, which should induce both overmen and miners to drill themselves into a proper performance of their duties in this respect, when they know how much depends on their individual carefulness and attention. I give below a list of the loss of life in the collieries of England, Scotland, and Wales, from the years 1856 to 1866, both inclusive, as given in the reports of the Inspectors of Coal Mines:—

Year.	Explosions.		Falls of coal and roof.		In shafts.		Miscellaneous and on surface.		Total.	Coal worked.	Proportion of deaths to coal got.
		p. c.		p. c.		p. c.		p. c.		Tons.	1 in tons.
1856	236	23	399	39	210	20	182	18	1027	66,645,450	64,971
1857	377	34	372	33	162	14	208	19	1119	65,394,707	58,440
1858	215	23	366	39	172	19	178	19	931	65,008,649	69,826
1859	95	11	399	44	191	21	220	24	905	71,979,765	79,400
1860	363	33	388	35	182	16	176	16	1109	80,042,698	72,175
1861	119	13	427	45	164	17	233	25	943	85,635,214	90,811
1862	190	17	422	37	137	12	384	34	1133	83,638,338	73,820
1863	163	18	407	45	147	16	190	21	907	88,292,515	97,345
1864	94	11	395	46	184	21	194	22	867	92,787,873	107,021
1865	168	17	381	40	163	16	272	27	984	98,911,169	100,519
1866	651	44	361	24	162	11	310	21	1484	108,728,881	67,877
Total.	2671	23	4317	38	1874	17	2547	22	11,409	899,065,259	78,803
Aver.	242		392		170		231		1,037		

It is lamentable to observe the recklessness exhibited by many who suffer in these accidents, particularly those occurring in shafts, such as being drawn into the pits by tubs, walking backwards into the pits with tubs, and standing at the pit bottom until the cage, or some other material, come down upon them. It is surprising that it should not be compulsory for colliery owners to provide the lifting covers for the pit tops, which are a great protection to life. That form which covers both the top and sides of the pit is to be preferred to the gates, which protect two sides only; the former are not required so high as the gates. The introduction of cages and wood guides where skips are used would, unquestionably, be valuable, as the deaths from the use of skips seem to be very great. Necessary adjuncts to cages are the bonnets, double chains connecting the rope with the side chains, and the ropes to be whole—that is, not capped or spliced where people are raised or lowered by them. The loss of life in shafts is 17 per cent., and from falls of roof and coal it is 38 per cent. in 11 years, of the total deaths. The latter accidents are to be attributed greatly to foolhardiness on the part of the miners themselves, and the best remedy for this serious loss of life is to set more timber, and have skilled deputies to do it. There are questions as to the system of working coal, and working the coal regularly and quickly off, which affect the state of the roof and timber requirements. Some roofs are very treacherous, and it is difficult to forsee the sudden falls of roof at "slips" and "bells." There is, unquestionably, much negligence shown in not placing sprags under the coal, and timbering insufficiently, as all colliers are not by any means competent to set timber, and to look after their own safety.

In the years 1865 and 1866 the deaths from falls in the Northumberland and Durham district, where the deputy system prevails, were 1 for 483,511 tons of coal got; the total deaths were 1 for 128,278 tons got. And in South Wales and Monmouthshire for the same years, where the colliers set timber, the deaths from falls were 1 for 168,000 tons got, and the total deaths were 1 for 67,664 tons. This indicates a great saving of human life with the deputy system, and, no doubt, it may be attributed greatly to superior skill in this branch of underground labour, but the roofs and coals of the North of England are considered much safer than those of South Wales and Monmouthshire. It is to be feared that there is a like amount of recklessness on the part of miners in connection with fire-damp and safety-lamps which has been observed with the other classes of accidents, but as the causes of explosion are generally involved in mystery, any opinion on this subject is mere matter of conjecture; but this is not always so, mines have been found to be in such a state as to leave little doubt as to the true cause of the explosion—bad management. In the present advanced state of the science of mining, if all parties did their duty explosions would rarely happen. Mr. Henry Hussey Vivian, the Member for Glamorganshire, has brought into notice a plan for dividing every mine into compartments where more than 100 men are employed, each having its own independent means of ventilation, and would cause a less number of people to be exposed at the same time. This is understood to be the panel system, which Mr. Buddle introduced with the same object. If an explosion occurred at the face of the panel of work, and was not a heavy one, there might be room in the back workings of the panel for the fire-damp to expand and burn out; if the explosion were a heavy one, the expansion would be too great for these workings, it would fly out, and towards the shaft, throwing down the stoppings and doors in its course. The force of explosion would be in proportion to the volume of inflammable mixture and its expansive force. It is not meant to deny the value of this suggestion, as, in the first case, a barrier interposed between a panel of workings where an explosion occurred and an adjoining panel would prevent it extending immediately to the latter, and, perhaps, confine the mischief done to that particular part of the workings.

Prevention is better than cure, and attention would be better bestowed on some well-devised system of preventing accidents. The double-shift system practised in the North of England has been lately brought under notice by Mr. Nixon, as adapted for the mines of South Wales, and as a means of saving life. The miners would be in the pit only seven instead of ten hours, and would run less risk of accidents in the shorter time. Instead of the whole of the men being in the pit at once, only half of them would be employed together, except at the moment of changing. The North Country colliers work in two shifts; the first shift commences at two o'clock in the morning, and their labour ends at nine, when the back shift relieves them and continues till four in the afternoon. The colliers here have merely to work the coal and fill it into tubs, the deputies set timber, lay roads, and look after the ventilation. The shifts change every week. The fore shiftmen have the whole day after nine or ten o'clock

for sleep and recreation, but they get up very early again, at 1 A.M., when the caller goes his rounds. In South Wales the miners work from seven to five in the afternoon; in addition to cutting and filling the coal they set their own timber, lay roads, and put their trams to the end of the stall. It is seldom that two men work together in a stall; they prefer each a boy to assist them. Hence it is that Welsh colliers take a great amount of pit-room. They seem to be jealous of each other on the score of each performing the same amount of work: this, and the early hours, have caused the colliers to look with disfavour on the double shift system. Welsh colliers often live a considerable distance from their work, but houses could, of course, be built near the pits for their accommodation. They usually pay rent for their houses as well as for coal.

The double shift is advantageous chiefly in saving pit-room, as if a man does as much work in seven as in ten hours only one-half the area need be opened out for the same quantity of coal obtained. The coalowner saves largely in timber, rails, and other materials, and is able to produce better ventilation from the same means. Suppose a colliery to have levels driven out from the pit on each side, north and south, and that there are four ways or headings driven to the rise out of the north levels, and four ways or headings also driven to the rise from the south levels. If the colliery were worked on the double shift system two ways on each side of the pit would furnish as much coal as the whole eight would do in the single shift, and one side could be reserved till the other side was worked out. In case of an explosion occurring with one side at work on double shift, there would, probably, be as great a loss of life as with the single shift, with both sides of the pit at work, as the explosion in the latter case, unless a very heavy one, would not extend from one side of the pit to the other. It depends, therefore, on the conditions under which the mine is found at the time, whether the double shift system would save life or not, It would not invariably do this to the extent that has been stated. It is considered that it would tend greatly to lessen the number of accidents, both from explosions, and from falls of roof and coal; in the former from having superior quantities of air at command for the area in work, and in the latter from skilled men as deputies being employed to timber and carry out the ventilating arrangements. The collier would merely have to cut and fill his coal, for which he would receive a price in proportion to the labour. These considerations should have some weight in inducing men to give the system a trial.—*June* 23. M. B. GARDNER.

BLASTING IN MINES—No. II.

SIR,—Where the hole has very strong water, as frequently happens, one important help to making it dry is a firm collar—that is, the rock at the top of the hole is firm. The dryest and hardest clay that can be obtained is used generally. Clay enough to fill 2 or 3 in. of the hole is then inserted, upon which there is placed a layer of hard stones, rammed down tightly and firmly, and the hole quite filled up with alternate layers of clay and stones, as tightly as they can be well laid. The hole being full, the end of a bar of iron is fitted to it, so snugly as to let neither gravel or clay rise around its sides in tamping, if possible. Then, one man takes a large sledge hammer and strikes this tamping bar (whilst another man holds), and tamps, or rather drives, the clay and gravel before the bar with great force. This process will so force the clay and gravel into the crevices of the rock that no ordinary water pressure can withstand. The bar is driven to the bottom of the hole, so as to completely force the drying material (clay and gravel) into the crevices. It may be here noted that in driving the bar it may be found needful to take it out of the hole frequently, to keep the layer of gravel under its point, in the shape of a floor, sufficiently thick to carry down the clay, gravel, &c., before it, in as perfect a manner as possible. This method of drying holes, if conducted properly, is so effectual that it needs seldom to be repeated, even under the most adverse circumstances, to make the hole dry. It has been found to answer when all ordinary methods have failed. As holes vary in size, it would be difficult to have a bar made to fit all holes, but it can be easily made of the required shape or size by hammering it against the rock.

The comparative strength of explosive compounds is very different in practice. Nitro-glycerine surpasses gunpowder very far in explosive force, and other compounds possess greater strength. Many compounds possess far greater strength than blasting powder, but, unfortunately, their use is attended with so great danger to life and limb as to prevent their being brought into general use. Much greater economy would result from the introduction of the strongest kinds of compounds, but from the objection that arises on account of the increased danger. The difference in the effect produced by the best gunpowder and ordinary blasting powder is very great in favour of the former, and its introduction into mines would effect a great economy, but for the objection alluded to, so that there is much practical wisdom displayed in the preparation of the blasting powder generally used, in reducing the danger for the sake of safety, although it may be at the expense of strength. It has been already shown that holes are charged in two ways, as circumstances require—by the raw powder and by cartridges. And as in practice there is a very material difference between the execution done when the hole is charged with raw powder or with cartridges, it is needful to impress this fact on the minds of those concerned. The difference of execution in favour of blasting with raw powder, when compared to blasting with cartridges, is very great indeed as a rule. The miner will exert his utmost skill to clay the hole dry, so that it may be charged with raw powder, before he will submit to charge the hole with a bag (cartridge), knowing that the execution of the bag charge will fall far short of that of raw powder. And when the ground is very strong the burden that can be severed by a charge of raw powder cannot be done with a cartridge charge. This is a well-known fact to every practical miner who has had experience therein; hence the mode of blasting by cartridges is avoided as much as possible by the skilled miner. The next consideration is how to treat the charge, and the manner of exploding it, so as to do the most execution; for it is a fact that a well-directed hole in rock may be thrown away by means of an unskilful manner of charging it. The charge should be inserted in the hole as snugly as is consistent with safety, and the hole tamped to such a state of solidity as can be safely done, in order to confine the powder. It has been abundantly proved that a great improvement may be made by barring of holes (which process has been previously described), and thereby confining the charge with greater rigidity. It may be difficult, under certain circumstances, to conveniently bar holes, but the practice may be much more frequently introduced than it is. Where holes are in shafts, winzes, or bottoms, and nothing overhead to place the bar against, a most effectual method is to place a large stone or piece of iron on the head of the bar. The instantaneous resistance exerted by it to the explosion is very great, as it prevents the tamping giving way: the consequence is the execution of the blast is much more effectual. Blasts that will not bring their burden under ordinary treatment will often do so by this. That blasting is attended with considerable danger, under the best circumstances, must be admitted; a large proportion of the accidents that take place, however, really occur for want of more care on the part of the miner. The causes calculated to explode the charge in course of charging are very numerous. To describe every possible cause of accident in blasting would be very difficult. The following casualties, one or other, cause the bulk of accidents:—

1.—Very fine-grained powder, on account of its liability to get into the crevices of the rock in which the hole is bored, is in tamping liable to be exploded, and convey the spark to the charge. Besides, it adheres more or less to the sides of the hole generally, more so than a rougher grained powder, and the best way to prevent danger arising therefrom is not to use the very fine-grained powder.

2.—In charging all holes air is taken in with the charge, in some instances a very large quantity. Now, it is a well-known fact that compressed air ignites tinder, and it will ignite powder also. I do not say that in ordinary blasting the quantity of air taken in with the charge would be likely to be sufficiently compressed as to ignite the charge, but when a large quantity of air is confined with the charge it is very imprudent to compress it excessively. In cases of very deep holes, that require but a small quantity of powder, there is, in the first place, the ordinary quantity of air taken in with the powder. In addition to this, it is the practice of some miners, after having put the charge into the hole, to prepare a plug of clay fitting the hole perfectly tight, and press it into the hole with the swabstick. The result is that a volume of air is more or less stopped into the hole, that ought not to be there. The tamping is placed on this layer of clay, and undue compression of the too large quantity of air in the hole is the result.

3.—A great many accidents occur through improperly tamping, in the following manner:—After the charge has been inserted in the hole a layer of tamping is put in with the swabstick. The ramming bar is then used, and sufficient care not being taken in putting in well pulverised and non-fiery material for tamping, it strikes fire under the blow, explodes the charge, and an accident is the result. There cannot be anything more wrong than to tamp or use the bar on the first layer of tamping put in on the powder. Nor is it safe, under any circumstances, to drive the charge with the tamping: that should be done sufficiently with the swabstick alone, before any tamping is placed on the charge. Some reckless miners actually settle down the powder with the ramming bar, which is generally of iron, and if they have not their limbs blown off for their stupidity and recklessness it is not their faults. The scrapers are usually of iron, and are used in charging holes, and it is not an unfrequent thing to see miners packing powder into the hole with this scraper, and that, too, in a very fiery rock. Others you may observe who are not sufficiently careful in selecting the least fiery material for tamping, nor are they careful in pulverising it, but use it in a very rough, and consequently highly dangerous, condition.

A very safe way of charging and tamping is as follows:—First settle down the charge with the swabstick, as solid as it reasonably should be. Then throw into the hole, on the powder, a very liberal quantity of water, and let the swabstick follow it at once, and swab it out. The water will destroy what powder may lodge about the sides or the hole and crevices in the rock, and wet the top of the charge. There is no need to fear about dealing with the water liberally, as it will not injure the charge, only the very top of it, thereby protecting it against any sparks that may be struck from the tamping. A little clay may be added (providing it is not used in such quantities and manner as to increase the amount of air to be confined in the hole, as before described), but it is scarcely needed under these circumstances. A wet rag would be very suitable. Then put in a layer of fine tamping, and settle it down with the swabstick only. The next layer may be tamped with the ramming bar, but it should be done gently. Subsequent layers should have the solidity given them by tamping consistent with safety. It should be strictly understood that the material used for tamping the holes should be well pulverised and of the least fiery nature. The foregoing method of charging and tamping holes would prevent many accidents, if carefully attended to. These precautions being used would prevent also, to a great extent, the cutting or severing the fuse in course of tamping, and thereby a twofold danger—first, the danger of firing at the instant, or severing it without immediate accident, but which is often followed by accidents of the severest kinds. For instance, the fuse may sever in tamping, and thereby fail to ignite the charge, and "miss the hole," which has, unless abandoned, to be picked out, and fresh charged. The dislodging charges from missed holes has been almost the greatest source of accidents that occur in blasting; and in Cornwall the number of blind men, made so by picking out charges from missed holes, is unfortunately great. The usual method of picking out holes is by an instrument having a sharp point, made for the purpose, of unseasoned iron. But instead of dislodging the charge with this instrument, the ordinary borer is very often used, which has a steel point, of course, and has been a very fruitful cause of accident. Holes miss, however, from other causes than cutting the fuse in tamping, such as the charges being destroyed by water, the fuses weak or gone dead, &c. The sure remedy against the danger of picking out missed holes is never to touch them. In mines generally the men are now forbidden to do so, under penalty. They retire from their work until such time as it shall be certain that no fire lingers in the fuse, and the charge is gone dead, which in dry ground requires a very considerable time. There is no particular danger, however, in the charge itself, but in the fuse, in which the fire lingers. And in certain instances, where the rock in which the holes have been comparatively very dry, the very long time that charges have exploded after the fuse has been fired has been most extraordinary. It is the opinion of a great many that the substance of the fuse (which is well saturated with tar generally) is the medium that holds the fire for a considerable time, rather than the powder the core is composed of. Be that as it may, it is certain that a core of semi-dead powder will hold fire for a great length of time. The rate of travel of the spark is reduced exceedingly, according to the degree of vitality that exists in it; and holes have been known to explode an hour or two after the fuse has been fired which were not more than 18 in. deep, thereby showing the exceedingly slow progress of the spark. Hence the wisdom of not visiting the scenes of missed holes to soon.—*Wenford, Bodmin.* GEORGE RICKARD.

CERTIFICATES FOR COLLIERY OFFICERS.

SIR,—But for the seriousness of the occasion, the remarkable interpretations which have been given to the thoroughly sensible observation of Mr. Vivian in the House of Commons—that he could not admit that the efficiency of an officer for a mine could be judged of from his knowledge of mathematics and history—might be passed by in silence, or accepted as simply confirmatory of Mr. Vivian's views, as the case might be; but when his remarks are met by such enquiries as—Can the knowledge of mathematics and history make a man less practical? and efforts are made to answer it in the negative, it is quite time to attempt to let a little of the truth be known. It is beyond a question that the scientific man is in all than relates to every-day life the most helpless and useless object that can be found, unless, indeed, it be the "perfect gentleman." Both may fairly be classed as living fossils—worthy of being looked at and admired by those who have no other or better means of passing their time, but likely to give rise to the feeling that even could they be changed from their fossil state to that of active vitality, they would afford less instruction to their observers, and would be greater nuisances to themselves. Mathematicians and historians are not only out of their proper sphere in a mine, but they are positively dangerous appendages—in fact, the proposition to employ mathematicians and historians to manage mines is as unworthy of consideration as would be that to place the management of one of the Cambridge Colleges in the hands of a charwoman and a cook. Of course the undergraduate requires his rooms cleaned and his commons provided, and, therefore, does not object to recognise the value of those ladies' services, but he would object to their occupying a place at the high table. In the same way the colliery owner recognises the importance of scientific research, and is ever ready to avail himself of the knowledge placed at his disposal by the scientific man, although he ranks him with the cook, and chooses to retain his right of swallowing or leaving the viands prepared for him, whether others may or may not regard them as suited to his palate.

In the acquisition of the knowledge requisite to qualify a man for the position of a colliery officer, there is a large amount of hard training to go through, and the advantage which a man has derived from that training can only be judged of by results. The value of a man as a colliery manager can no more be judged of from his ability to pass a written or oral examination, even upon colliery affairs, than from the ascertaining of his weight. He might know Prof. Warington Smyth's Treatise on Coal Mining by heart, yet he might be unfit to be trusted with the management; or he might never have seen that book, and yet be more competent than the Professor himself to manage a pit, employing 500 men, with credit to himself and with safety to the men. A man may write a book upon a subject of which he knows comparatively nothing, and a man who thoroughly understands a subject may be unable to write a book. Coalowners, as a rule, well know the importance of the maxim that "the cobbler should not go beyond his last," and it would probably be better for both colliery officers and colliers if some of those who desire to be their friends would study that maxim a little more diligently. But there is an objection to certificating colliery officers even greater than that would result from testing their ability by the standard of the works published by the Professors at the Royal School of Mines—Percy's "Metallurgy," Hoffman's "Modern Chemistry," Smyth's "Coal Mining," Hunt's "Statistics," and such like amusing and interesting books—which is that it would effectually prevent the large majority of intelligent working colliers from reaching any higher position in the mine, and, practically, would introduce a complete purchase system in the ranks of colliery officers.

But certificates are altogether uncalled for, because the means by which the qualifications of a man who offers himself for appointment to an office in a colliery are judged of by the coalowner or manager afford greater security than could be hoped for under the certificating system. The question asked is—Where have you previously been employed, and how long? and the reply usually gives the employer all the information he requires. He knows generally how the pit is managed, under whose direction the man has been, and the facilities he has probably possessed for thoroughly learning his business. These considerations, and a few questions far more practical and conclusive as to ability than those which have been put at the School of Mines to candidates for the office of Government Inspector, are better calculated to ensure the safe and proper working of the pit than the appointment of men upon the faith of the certificate of a Board of Examiners, even if Lord Kinnaird, Mr. Green, Mr. Ayrton, and the professors of the Royal School of Mines composed it.

June 24. D. E.

SUBTERRANEAN TEMPERATURE.

Your correspondent, "H. F. R.," in his letter of the 2d inst., says that "enquiries into the internal temperature of the earth, as they have at present been conducted, are so many records of the carelessness of the geologists and physicists who have conducted them, and the conclusions based upon them are, therefore, unreliable."

As the subject is of great importance, not only as it may affect geological hypotheses, but yet more in reference to the practicability of mining the deeper seams of coal, it seems incumbent on your correspondent to give hints as to the methods of observation which he thinks ought to be pursued.

The temperature of the earth will not be found to be everywhere the same at like depths from the surface. It must be affected by the nature of the rocks modifying their power of conducting heat, by the position of the strata, by the percolation of cold water from above, and especially by the facilities for the ascent of hot water, and at yet greater depths of hot vapour.

There are very many springs of more than 200° Fahr. The curves of the isothermal lines doubtless vary in different mountain chains, and in different portions of the same range. C. F.

June 22.

FOREIGN LOANS, AND REPUDIATION.

SIR,—There is, unfortunately, a tendency on the part of two or three foreign States, debtors to England, to confiscatory measures, and especially so by Austria and Italy. These kingdoms, requiring external aid, and already greatly beholden to us for advances of large loans, are following, to some extent, the course taken by Spain and Venezuela, and are proposing to enact measures which are tantamount to the repudiation of a portion of their just obligations. Unless such measures are summarily discouraged—nay, definitively and resolutely denounced at once—this may prove the beginning of what will obviously be the end of English capitalists' credulity in the honesty and good faith of foreign nations in time of need as affects their commercial engagements. National debt is not altogether new to us, for we are burdened greatly ourselves, and have, in times past, suffered greatly from advancing largely to Spain, Portugal, America, and other countries; and we, of all nations, are the most deeply interested in that which affects good faith. The vital spark of honourable conduct being impugned by the acts of our debtors should open our eyes to the folly of being tempted by high rates of interest. No inducements of immediate gains can in the sequel reward us sufficiently to meet the losses incipient upon distrust and broken engagements, and especially so if in the conflict of political and fiscal disarrangements or difficulties we have to grant fresh loans in order to meet interests accruing, or due, on those already contracted for.

The facts as regard Austria stand nearly thus:—A law has passed through Parliament deducting 20 per cent. from the coupons of her debt—that is, she absolutely refuses to pay one-fifth part of her money obligation, which she has pledged herself to pay to her creditors. This affects the English loan of 1859 to the extent of 4,000,000*l.* sterling. This loan of 20,000,000*l.* was at 5 per cent., redeemable in drawings at par over a period of 57 years. The latest quotation on our market was 62—a discount of 38 per cent.; the interest, therefore, received by the holders of bonds would be 3*l.* 1s. annually, but under the new law this will be reduced to 2*l.* 8s. 9d.—a most iniquitous and disreputable repudiation of the just rights of her English creditors. All this conduct on the part of Austria affords ground for grave reflection; and if the rule just laid down is to be followed, lenders on our Stock Exchange will be found no longer. Continual default, progressive insolvency, are simply impracticable to progression and impossible to practice without the inevitable and disastrous consequences of national bankruptcy, and we, therefore, should, or ought to, be informed at once if these things are or are not to be, or we must close our book with the foreigner, for the aspect of affairs, as at present existing, must not only be resolutely discountenanced by all, but be refused admission into commercial councils from the onset.

Italy is now struggling with internal difficulties, which leave her no time or energy to devote to foreign policy. The evil results of ages of Bourbon and Papal tyranny in the demoralisation of the people have not been removed—have, in fact, scarcely been laid bare—by the operation of seven years of freedom. The social conditions of those provinces which experienced the *blessings* of Papal rule is, of course, much the worst. Naples itself has manifestly improved, but the Romagna is still in a fearful state—almost as lawless and depraved as ever. The results of 300 years of priestly government—in March last 5749 persons were arrested, 220 for murder, 289 for violence, 1450 for theft, 846 merely wounding, 297 highway robbery, and 1440 simply as thieves and vagabonds. The bonds of religion, such as it was of old, have only been loosened. Education, it is true, is at work for the future, but in the meanwhile the laws of the country are in abeyance for correction of practical abuses—energy and courage are lacking on the part of the Government and the people, and whilst false philanthropy and sickly sentimentalism prevail among the legislators, leniency of punishment, instead of proving a remedy, only adds to the frequency and enormity of crimes. Every region and district of the Peninsula exhibit the like characteristics; Calabria is still the land of nocturnal brigandage, Romagna still the theatre of mid-day assassination. It is only in Piedmont and Lombardy, and to some extent in Tuscany, that public security exists upon the average footing of civilised communities. There are, happily, social abuses that will not stand the continued attacks of unfettered public opinion, yet England would do well to let the organisation of this country and the people to work itself into some approach to decency and order before she squanders her money by way of loans to a nation that may be capable in a very short period of time, and upon the slightest and shallowest pretences, to violate or abridge their pledges or obligations, even should they fall short of open and absolute repudiation. At present the Italian debt due to this country is only 8,000,000*l.*, issued at 77½, and saleable at par, redeemable also at par in 15 years from 1865—thus, in addition to the bonus the holder receives 6½ per cent. interest for his money. This is if the proposal introduced before the Parliament of Italy with all due form of law is rejected; but not so if promulgated, passed, and sanctioned by that Government, for it is then practically to levy on the holders of the national debt a tax of 10 per cent., which will, in fact, reduce the interest of 5 per cent. paid to the bondholders to 4½ per cent. annually, or in effect to repudiate, or rather to cancel, the value of the Italian loan by the sum of 800,000*l.*

The resources of the Bank of England still accumulate. The coin and bullion now amount to 22,571,045*l.*, against notes in circulation amounting only to 23,524,735*l.*, and the rate of discount for first-class three months' paper is in the open market only 1½ per cent., although the minimum charged by the Bank is still 2 per cent. Money is becoming a glut in commercial circles, and the public possess no medium for its employment. Joint-stock banks and discount companies give only 1 per cent. for it at call, and there is still prevailing so much distrust as to securities in general that the public refuses to part with their accumulated and rapidly increasing hords, no matter how sound and *bona fide* may be the property, or dispro-portionate to market quotations may be the interest paid thereon. This hitherto cronic inactivity must soon give place to renewed confidence, for the wants and requirements of the commonwealth have

already been too long neglected, whilst the energies and industry of the enterprising and speculative members of society have lain dormant from sheer lack of scope and field for action and display of power. The chances of a superabundant harvest, and the sound position of trade and commerce, so far as freedom from excitement or any approach at inflation, give a tone and character to the present and future that must soon dispel or quicken the inanity so long prevailing, and awake to fresh and profitable action the dormant qualities of both mind and body of the ever-restless yet progressive English. For some time past the only securities in favour were home Government Stocks, still gradually creeping into repute arose Indian and Colonial Guarantees and Bonds; and next, as confidence gradually extended, Foreign Government Stocks became recognised, though this class of investments did not greatly move in prices, upon a comparison with those prevailing over the past two years. Chilian, it is true, issued in 1866, bearing 7 per cent., at 92*l.*, has risen to 103*l.*, and the 6 per Cents. of 1867 from 84*l.* to 96*l.* Danish 5 per Cents., issued in 1864 at 94½, stand at 100; but, on the contrary, we append the issue prices, and those of to-day, of several other foreign loans that in our opinion show but very questionable recognition of their respective merits by the English creditor:—

	Issued at	Price.	Interest per ann.
BRAZILIAN.			
4½ per cent., 1863	£88	£66	£6 15 0
5 per cent., 1865	74	76	6 11 6
DANUBIAN.			
7 per cent., 1864	86	74	9 9 0
8 per cent., 1867	71	82	9 15 0
EGYPTIAN.			
7 per cent., 1864	93	83	8 10 0
7 per cent., 1866	90	74	9 9 0
9 per cent., 1867	90	88	10 5 0
PERUVIAN.			
5 per cent., 1865	83½	80	5 13 6
4½ per cent., 1862	93	97	4 13 0
PORTUGUESE.			
3 per cent., 1853-1867	48-38½	41	7 5 0
RUSSIAN.			
5 per cent., 1822	82	86	5 16 3
3 per cent., 1859	68	54	5 11 9
5 per cent., 1862	94	85	5 17 6
5 per cent., 1864-6	85-6	89	5 12 6
4 per cent., 1867	61	65	6 2 6
TURKISH.			
6 per cent., 1854	80	86	6 19 6
6 per cent., 1862	68	65	9 5 0
6 per cent., 1863-1864	57½	60	10 0 0
5 per cent., 1865	50	39	15 10 0

There is a strong feeling evinced on the Continent to launch out into speculative dealings, especially so at Florence, where Austrian securities are not regarded with favour, whilst railway and several miscellaneous properties of enterprising character are much sought after. This revival, and the improved tone and *esprit* exhibited likewise in France, are evidently the initiative principles of advancing confidence on the part of the world, and as almost every description of property is sadly depressed, and sells at reduced prices, that ought and should be regarded as the minimum standard of commercial stagnation, parties investing their capital may with fairness not only expect to receive high rates of interest for their money, but likewise through the natural advance, incipient on increased transactions and more active and buoyant markets, greatly augmented commercial value of their property. There is every evidence of an abundant harvest at home and abroad, whilst the overcharged exchequers of both France and England demand increased facilities for employment of money, otherwise there can be no possible gains to either the Bank of France or England from the possession of so much unemployed wealth.

The satisfactory and cheering movements now evidently at work in several parts of the Continent will soon spread to England, for we are never slow to follow in the paths of action, whether in the growth of wealth or the accumulation of honour. The spread of railways in India, and the prosperity of the several dependencies, attest the worth of England's greatness and fostering care and help in the days of peace, prosperity, and progression; as the fate of Abyssinia proves that whenever her honour and social status is assailed the introduction and dissemination of Christianity and intellectual culture attacked and checked, then that her power of exacting redress is as successful as ever, and far puisant beyond requiring auxiliary aid to conquer her antagonists. R. TREDINNICK,

London, June 25. Consulting Engineer.

PREPARATION OF MAGNESIA EMPLOYED AS A REFRACTORY MATERIAL—No. II.

SIR,—Having mentioned in my last letter (in the Supplement to the Journal of May 9) that Mr. Caron's process is peculiarly adapted to the magnesia pencils and cylinders of the Drummond and Carlevaris lights, I now give some details as to their fabrication and behaviour under the flame. Mr. Caron remarks in his Memoir that the effects of impurities contained in the magnesia are more injurious to the pencils employed in lighting than to refractory bricks; a small quantity of extraneous matter cannot give rise to a deleterious fusibility, but it can weaken the light, and often colour it sensibly. Thus, for example, in making use of the carbonate of magnesia from Eubea the whitest pieces and those most free from serpentine and silica must be picked out, otherwise two-thirds, or even the four-fifths of the light given by pure magnesia will be lost. This falling-off is not due to the oxides of iron and manganese contained in the carbonate, but to the silica. Mr. Caron has also remarked that silica combined with other bodies capable of becoming incandescent diminishes and gives a yellow colour to the light required to be produced in a pure state. Lime, in a very small proportion, is not injurious; it only gives a very weak violet rose-coloured tinge to the flame, which does not prevent distinguishing the most delicate shades of coloured substances as clearly as in broad daylight.

The cylinders or crayons used for the Drummond lime and magnesia lights differ from those employed by Mr. Carlevaris in this respect, that the former are mechanically and chemically prepared before they are submitted to the flame; in the latter case the cylinders used are formed of a chemically pure substance, which undergoes a transformation under the action of the oxyhydrogen jet. This material is the chloride of magnesium, a yellowish transparent crystalline substance, transformed by the oxyhydrogen flame into magnesia (by the expulsion of the chlorine and the absorption of oxygen), in the form of a perfectly white and pretty hard cylinder, quite free from silica. The Carlevaris light is extremely beautiful and intense. To give an idea of its power, it is only necessary to state that with one Carlevaris lamp, placed in a shed in the Champ de Mars during the Paris Exhibition, we could read a newspaper at night on the heights of Trocadero, at the Place du Roi de Rome.

To return to Mr. Caron. The magnesia, being rendered as pure and as free from silica as possible, is now submitted to the same treatment as that employed for the refractory bricks, described in my last letter, and then compressed in tempered steel moulds, where it takes the form of cylindrical crayons, from 4 to 5 centimetres long. These can also be obtained by the humid process; the magnesia, strongly calcined and kneaded with water saturated with boracic acid, is lightly heaped in a glass tube, which it quits in the shape of a cylinder, received horizontally on a plate of glass, slightly oiled. When dried, the crayon is submitted to an intense heat, and often becomes more refractory than cylinders obtained by compression. Mr. Caron finds that the boracic acid does not sensibly colour the light from the magnesia thus prepared. The magnesia sticks, he finds, break off very often just below the heated part when they are extinguished, if they are supported from below, so he finds that they should be supported from above, allowing the flame to play vertically against the bottom of the crayon. They do not break then, and the light is sensibly increased.

It is important to consider the relation between the mass to be heated and the heat produced by a determined consumption of the mixture of the two gases, but the diameter of the cylinders can only be ascertained by practical trials. Mr. Caron gives us the following figures and results, compared with the standard bat's-wing burner of Paris, consuming 140 litres (about 5 cubic feet) of gas per hour, at a water-pressure of 2 to 3 centimetres—No. 1: compressed pencils; diameter, 8 millimetres; height, 40 millimetres; quantity of light obtained (that of the standard being 1·0), 5·0; oxygen per hour, 80 litres; pressure, 7 centimetres of water; common gas per hour 70 litres; water-pressure of ditto, 6 per cent.—No. 2: same composition; diameter, 6 millimetres; height, 40 millimetres; light produced, 6·5; oxygen per hour, 80 litres; pressure, 7 per cent.; gas, 70 litres; pressure, 6 per cent.—No. 3: non-compressed pencils (humid process); diameter and other figures same as No. 2.—No. 4: same composition as the last; diameter, 2 millimetres; height, 40; light obtained, 3·5; oxygen, 30 litres; water-pressure, 7 per cent.; gas, 30 litres; water-pressure, 6 per cent.

Now, taking the price of oxygen (Paris) at 1 fr. 50 c. per cubic metre (about 1*l.* 15s. 5d. per 1000 cubic feet), and that of common gas (Paris), at 30 centimes per metre cube (7s. 1d. per 1000 ft.), and applying them to No. 2 crayon, 6 millimetres diameter, we have—oxygen per hour, 12 c.; gas, 2 c.: total, 14 c., for one hour's lighting with the oxyhydrogen magnesia light, the illuminating power being 6½ times that of the standard. The common gas burned at the rate of 140 litres per hour. At 30 c. the cubic metre, it costs 4·2 centimes, or ·042 c. Multiplying this by 6·5, we have 27 c. for the cost per hour of a gas-light equal in illuminating power to an oxyhydrogen light costing only 14 c. per hour. Thus, the magnesia light costs only one-half of that of coal gas, and with some practical economical improvements the oxyhydrogen light may be rendered still more advantageous. Mr. Caron having shown the advantages of magnesia lighting, points out its defects. Submitted to intense heat, the best prepared magnesia slowly volatilises; if pure hydrogen be employed instead of common gas the wear is greater and more rapid, so that the spoiled crayons must be renewed at the end of a few days. He has, therefore, made a series of experiments to discover a body that will remain absolutely fixed in the enormous heat produced by the combustion of the two gases. In this he has succeeded, and has presented us with *zircon*, a notice of which I reserve for my next.

Paris, June 20. C. H. DOWLING.

THE MINES OF THE CHONTALES COMPANY.

SIR,—At the meeting of the Chontales Company last week, to which I though not a shareholder, was specially invited on account of my recent visit to Chontales, I could not help being struck by everyone present neglecting to point out any bright side to what must have seemed, to those unacquainted with the exact state of things, very gloomy indeed; though, if the speakers could have seen the mines a year ago, when the shares were at par, it would have been much more difficult to perceive any break in the thick veil of troubles and uncertainties that then enveloped them than it now is, with the shares at 2*l.* When at the mines, in April last, I was continually being told—"Oh! you should have seen what it was a year ago."

The following are now accomplished facts, and I think satisfactory ones:—Tramways and roads, at any rate better than none; mines in good working order; 12 stamps, and a 25-horse power engine (a very good one) hard at work, and now properly supplied with quartz; joining on to these stamps eight arastras—very useful in their way as an auxiliary force; a plentiful supply of the best English labour, more natives than can be employed, an excellent staff of officers in every department, and, by far the most important of all, the accession of Mr. Belt as manager.

As an eye-witness, I can testify that in the short space of two months the aspect of affairs changed for the better in the most marvellous way. Unproductive works (and there were many) were stopped; a steam-engine was brought in entire, a distance of more than a mile (beginning with the ascent of an almost perpendicular hill), and placed in a position so as to work with ease the 12 stamps in connection with the eight arastras; the tramways were improved, and in places reconstructed; the mines were stoped on the most improved plan; the commissariat expenses reduced 50 per cent., and innumerable other things done by Mr. Belt that only great tact, energy, and a thorough knowledge of his profession could have suggested or accomplished. One great element in the rapidity and success of all these improvements, doubtless, is the hearty and skilful way in which Mr. Belt has been seconded by his officers and men. No one could see all this without coming to the same conclusion as I did—that the Chontales Company has very much to congratulate themselves on; they always did have good mines—now they have good management. I hear they want one more element of success in all undertakings—money, and I sincerely hope it may be forthcoming.

JULIUS ALINGTON.

Office of the Javali Company, 4, Westminster Chambers, Victoria-st., June 23.

MINING ON THE RHINE—No. IV.

SIR,—Step with me across the Rhine, and let us examine a cross-course, or lead and blende lode. The lodes of Marienberg, St. Josephsberg, and Clementslust, which run nearly north and south or almost parallel with, and about two English miles distant from, the Rhine, on its right bank, are copper; therefore, one must reverse the Cornish nomenclature, and call the east and west, being the lead and blende lodes, cross-courses. In the quotation from "Bradshaw," in No. 1, Marienberg and St. Josephsberg are stated to be on the "left bank," which renders it necessary to state that the left bank of a river is that which is at the traveller's left hand as he descends the river to its mouth. My attention was specially directed to this mine by its being offered for sale, when it was described as 2¼ miles English from a railway station, and equidistant from a shipping port on the Rhine. The grant in perpetuity. The extent 245,183 square lachters.* The mining operations in the centre of the sett. The length of the lodes within the grant about 1¾ English miles. The breadth about 1¼. A careful examination of the grants, maps, plans, and sections, together with an oral examination of some old miners, convinced me of the correctness of the report from the pen of one of the most experienced mine managers and engineers in the district, and giving, as it does, a clear description of two of the great lead and blende cross-courses, furnishes just the material, with three or four further reports on lodes, cross-courses, and stratification, for some practical hints for working in the district, in which the deviations and divergence from ordinary laws must in no small degree perplex men whose experience has been chiefly confined to British mining. In this district success has been the rule, and failure, with due prudence and management, the exception; but an exclusive English management does not succeed. The following is the report of Herr Mühlenbein:—"The mine is two English miles from the railway station, and about the same distance from the Rhine. The concession is 245,183 square lachters. There are many lodes which contain some little copper, lead, and blende. The stratum is grauwacke and soft clay-slate, with numerous veins of soft quartz, spotted with lead, running through the stratum. Many years since the mine was worked for lead only. In 1800 Herr Bleibtren drove an adit about 2 lachters deeper than the old one, and worked away all the lead ore above that level. In 1820 the Brothers Rhodius purchased the mine, and appointed me their agent and manager. The lead had all been taken away by the former workers. Some copper and a large quantity of lead had been returned above the adit; labour and material were cheap, and each year the adventurers made large profits. The length of the adits and cross-cuts is 152 lachters. There is a channel of ground running north-east and south-west, about 10 lachters wide, soft quartz, in which are four lodes, each from 3 to 7 ft. wide, carrying shutes or leaders of lead and blende, averaging 6 to 12 in.; also a second channel of ground, from 3 to 8 ft. wide, running east and west, which also has one leader of very rich lead ore, from 6 in. to 1 ft. wide. The old workers have taken away all the lode as deep as they could go for water. These channels of ground unite going eastward. All the leaders will, from their underlay, unite or form junctions at about 20 lachters under the adit, and it is certain that under these junctions large deposits of lead ore will be found. The lodes will contain only lead in depth. In 1867 arrangements were made to rework this mine, to sink a new engine-shaft, and to erect an engine; but the principal shareholder died, and the plan was abandoned." The estimate for working to the 30 lachter under the adit, with all necessary machinery, and for driving levels at the 15 and 30 lachters deep, was given in detail, and amounted to 2226*l.*, for which sum the work can be done. "In the last working the roads were very bad, but a new and very good road has been made from the station and river respectively, which passes through the mine, and materials and ores can now be sent to and from the rail and shipping place at a very low cost. In conclusion, I would remark that a very profitable mine can be opened if the undertaking be vigorously and economically worked, and, from the proved contents of the lodes, it is quite certain that under these conditions large profits must be made. The mine was worked for many years under my management, and made large profits."

The mine was not sold, but a price put upon it, in my judgment very moderate, and should any of your readers wish for further information they can be placed in direct communication with the vendors. If the mine be sold, a considerable portion of the purchase-money might remain at interest on a mortgage of the mine, whilst at least one-sixth part of the undertaking could be disposed of in this country to men well known as experienced miners and wealthy merchants.—*Bonn, June 17.* A CORRESPONDENT.

* A lachter is 6 ft. 10⅛ in.

THE NEW AND THE DEEP MINES OF CORNWALL.

SIR,—The letter inserted in last week's *Mining Journal*, by Mr. R. Tredinnick, contains a great many facts as to the profits realised by legitimate mining; but Mr. Tredinnick was wrong when he stated that the deeper the lodes or veins are wrought in Cornwall the richer they are found to be. Now, I take one of the mines in this letter—Dolcoath. This mine, some 40 or 50 years ago, was one of the richest copper mines in Cornwall, and yielded much greater returns in copper ore annually than is now raised in tin. Dolcoath, like many of the old and very rich mines in Cornwall, after working, probably, about a century, has ceased to produce copper ore; and, after passing from one strata of ground into another, a change in its mineral is found to exist; and this result is not the case with Dolcoath Mine only, but applies to Cook's Kitchen, Tincroft, Carn Brea, Wheal Buller, and other mines that I could name. The dividends now paying from the mines above named are trifling to what was realised from the same mines when they were found to be productive in *copper*. Tin mines, with very few exceptions, have not paid like copper mines; and where a 100,000*l.* profit has been realised out of tin mines, ten times this sum has invariably been gained from copper mines; but I contend that mines when wrought to the depth of 400 yards, or 200 fms., below the adit level seldom pay the working charges below that depth. Some persons I have heard say that because a mine has paid a million sterling profit that is the place or spot to re-open. Those who have embarked their capital in old and abandoned mines during the last 20 or 30 years have found out the truth to their sorrow. It is possible to make a chain in length that will not hold its own weight; and this applies to the working of old mines. The Great Wheal Vor is another example of the folly of re-opening old mines; the result was that 200,000*l.* was sunk and lost. The richest deposits of copper ore ever found in Great Britain were, probably, those found in Ecton and North Wales; the first deposit was in limestone, and the latter in killas or slate, but became unproductive below 300 yards deep. The greatest deposits of copper hitherto found in Cornwall and Devon have been discovered in the clay-slate, killas, and granite; but large deposits of this mineral are found in greenstone, porphyry, or elvan—particularly at the intersection of one of these strata or rock with another. Some of the richest carbonate of copper has been found where the schistose or killas is crossed by an elvan course, such as in the old Fortune Mine, at Ludgvan, in Cornwall. Enough at present is not doing to discover new deposits of minerals; the chimney of a deposit of copper may only be a few feet in length near the surface or at the adits or day level, and yet the lode may contain immense deposits of ore underneath. The chimney of a deposit of copper ore invariably contains what is locally termed in mining language gossan, as all practical miners well know. The ancients took more trouble, and paid more attention to this description of labour—driving levels—than men of the present day think of doing; this is, probably, the reason why nobody at present can discover a new mine. Formerly one or more new discoveries were annually made. The system is entirely altered, and until people will go back to the system pursued by our forefathers no new discoveries in this country can be found, as most of the deposits of mineral cropping up to the surface have been discovered. People do not embark in what may be termed a speculation until an outbreak, if I may so speak, or a rage for any particular enterprise takes place; then everybody rushes into the wildest and most risky things introduced, and the majority of persons who engage in such enterprises know just as much practically of the business as the pursuit knows about them. I daily hear from various persons how strange it is that no new mines are being discovered, as formerly. The answer is plain enough to all practical men connected with mining operations—unless we search we cannot expect to find. It is also true that Providence appears at times to cause a discovery to be made where no one would think of digging in search of wealth—because nothing has been discovered in the immediate district, is invariably the reply to all new places. I well remember that when the Devon Consols Mine was first discovered people (the prejudiced ones) said, "Oh! the discovery is only a flash in the pan."

One or two such flashes in the pan are greatly wanted at the present time, probably at no period more so. The dealers are complaining that there is little or nothing doing in the market, and justly so. There is little or no margin left for persons to profit by any investment in the present market stock, but, like Devon Consols, with an outlay of 1024*l.*, and pay some 40,000*l.* a year profit, and the mine rise in the market to half a million of money, then men will have something to deal with. A portion of the spare capital can at present be well invested in the discovery of new deposits. The writer of this letter and friends have been fortunate to discover at least half a dozen mines, some of which have paid 100,000*l.* profit on an outlay of some 10,000 or 12,000*l.*, and one or two other such places may yet be found. The largest dividends I ever remember being paid was when the price of tin, copper, and lead was below the present market price for these metals; but present prices will not suit old, deep, and, I may say, nearly exhausted mines, and, if not in quantity, the quality of the mineral is not found to exist in the ore—I mean copper.

June 22. A. BENNETT.

THE WORKING OF MINERAL PROPERTIES.

SIR,—I now proceed to fulfil my promise, by giving you my views on this subject. We are met at the outset by the question—How does it occur that so many mineral properties turn out unprofitable? If we look to the reports of the Chancery Court, one is greatly struck by the vast number of petitions that are presented in the matter of Limited Liability Companies every week, besides those that are wound-up voluntarily, and the still greater number that are working at a loss. I believe I am near the mark when I assert that about 25 per cent. only of mineral properties arrive at a satisfactory position. Of course, I am not ignorant that mineral property is like other pursuits, where there are chances of success *pro* and *con.*; and whether 25 per cent. of the whole undertakings is a fair percentage, or whether it is equivalent to the success arrived at in other pursuits, is a question of fair discussion. For myself, I am of like opinion as has been expressed frequently in the *Mining Journal*, that mining, as a commercial pursuit, can be made as safe as any other commercial undertaking, provided always the same amount of ability, honesty, and capital be brought to bear as there is in other commercial pursuits. Capital has been brought to bear in a wonderful degree on mining enterprises, but whether ability and honesty have been brought to bear in a corresponding degree is, I think, a question of great doubt. Indeed, were it advisable, I could quote a great many cases in which chicanery and ignorance have been the prominent characteristics in mining undertakings. How many companies have been promoted to benefit the promoters only? How many prospectuses have been published with hardly a particle of truth in them, designed only to bait an unwary public? How many undertakings have been commenced in situations where every known law of Nature and common sense proclaimed loudly would be futile? No wise farmer would sow wheat in land which is fitted to grow only oats; and no carpenter would be insane enough to build a large vessel of ash, because common sense and experience would teach them it would be useless. Yet, how often do we see the correlative of this done in the mining world. In this I am fully of Nicholas Ennor's opinion, and my experience in nearly every part of the kingdom has confirmed it, that every metal and mineral is formed under a distinct law, chiefly by chemical combinations; and nowhere are mineral deposits abundantly found except where these laws have been and are favourably operating. Mr. N. Ennor, than whom there is not a more practical man in the mining world, has frequently proved this. Now, where the favourable operations of one of the laws of Nature have been found, and the exact condi-

tions of the working of the law has been reduced to anything like a certainty, or where the laws of Nature have been found to have operated destructively to mineral deposits, we may be certain those laws will act always the same, provided the circumstances be the same. Even this, combined with a little practical experience, would, we presume, prevent a host of misfortunes in the mining world. Being a short time ago in South Wales I was very much surprised to find that within a radius of six or seven miles of Fishguard slate quarries had been worked, and capital very little short of a quarter of a million had been spent. If those I saw were a fair sample, and I was informed they were the best, there certainly was hardly a redeeming quality in them. Therefore, the question is, if the mining world were purged of these and other abuses, could the proportion of successful undertakings be materially augmented? I will refer to this next week. SAMUEL JENKIN.

MINING IN WALES.

SIR,—Many of the readers of your valuable Journal will be glad to know that the London and North-Western Railway have opened a branch from Llandovery to Llandwrtyd, making a direct communication from Liverpool, Manchester, and London, with Swansea and Carmarthen. This has already put more spirit into mining in the neighbourhood of Llandwrtyd and Llandovery, as the carriage of ore and materials will be greatly reduced. There are two or three silver-lead mines on the eve of starting—one, the Silver Hill Silver-Lead Mine—by the spirited proprietors, Messrs. J. H. Skeys and Co. About 30,000*l.* are subscribed to work this valuable property, which, it is fully expected, will turn out a good, lasting, and profitable mine with a small outlay. It has been favourably reported on by mining agents of high standing. There is another mine also about starting, adjoining, and on the same lodes as the well-known great Nant-y-Mwyn Lead Mine: this mine has been regularly at work ever since the reign of King Charles the First, and has yielded over two millions sterling profit, and it is now making splendid returns. Some of these lodes have produced as much as 18 tons of lead ore per fathom, worth upwards of 200*l.* in every 6 feet; and, by the reports of the most experienced authorities, the adjoining mine will turn out quite as good as the old Nant-y-Mwyn, by a small outlay. S. W.

London, June 25.

MINING IN THE DEVON CONSOLS DISTRICT.

THE NEW GREAT CONSOLS MINE.

SIR,—I was a shareholder in this property when it was known as Great Wheal Martha, which was a leading market mine. The company failed, from inadequate capital, to provide the mine with effective machinery, although all were agreed that by sinking a remunerative mine would be opened up. I remember that, among others, Mr. J. Y. Watson, in his "Cornish Notes," stated that "by a proper and vigorous mode of working, by getting levels extended, and ore ground opened out, and by sinking the shaft as quickly as possible 10 or 20 fms. deeper, there may be a fine mine opened out." In May, 1863, the mine sold 426 tons of ore, of which 20 tons fetched 8*l.* 15*s.* 6*d.* per ton; and during the quarter ending September, 1863, 895 tons of ore were sold, which realised 2344*l.* The shares commanded a high premium, and, although the mine continued to return sufficient ore to meet the costs of development, the shareholders—or at least a moiety of them—were either unwilling or unable to provide the mine with more powerful machinery, which caused the suspension of operations, just at the point where success had been foreshadowed. The present company (the New Great Consols) has provided ample machinery for sinking the mine far below the required depth, and the operations are in every respect progressing most satisfactorily. How is it, then, that a property so favourably situated, and admittedly valuable, is never referred to in your columns, and that the shares, so far as I know, are but seldom quoted? AN ORIGINAL SHAREHOLDER.

Liverpool, June 23.

YUDANAMUTANA COPPER MINING COMPANY, SOUTH AUSTRALIA (LIMITED).

TO THE SHAREHOLDERS.

GENTLEMEN,—I beg the favour of the Editor of the *Mining Journal* to allow me to inform my brother shareholders that I am in receipt of another circular from Mr. O'Farrell. He commences by informing us he attended the late meeting; those of us who were there well recollect how small he looked, and in the presence of, and face to face with, the *bona fide* shareholders how little he had to say. In his third paragraph I find Mr. O'Farrell is an unbeliever; his hope is not of the genuine kind. I wish with him, and, if it is possible, his mind may be "illumined," and then he would delight in the truth. No shareholder can for a moment believe Mr. O'Farrell has the interest of the company at heart, or think him capable of doing much injury, as his motives have long since been known. But I would strenuously recommend the directors to reform the system of their monthly reports, also their accounts, and push on all operations with systematic energy. As our property is so far off it appears absolutely necessary our monthly reports should be full and complete, which would remove the possibility of Mr. O'Farrell imposing on credulous shareholders by his half-worded expressions. If there is another managing director chosen, I trust these things will be fully and completely carried out, then each shareholder could determine the value of his property, and the Stock Exchange would not be liable to depress our property in the manner they have. Allow me to suggest something of the following nature, which should be arranged in a tabular form, and which could be very simply done; and I also hope some shareholder will take the matter up, and not let the subject drop till a reform is effected, for the last report reads to me very meagre:—Number of men and boys employed, and where; whether on tutwork, raising ore, sinking shafts, erecting additional machinery, or on surface; whether smiths, carpenters, or engineers (if any); whether employed on pitches or stoping; whether dressing ore; how many tons smelted, &c.; with the monthly cost of labour, and with all other outgoings; the quantity and percentage of ore raised, how much smelted, ditto on hand, how much sold, and what it realised—in fact, as above stated, a *complete statement*. When these things are properly carried out, as they are in the Don Pedro Gold Mining Company, I feel assured we shall receive no more of Mr. O'Farrell's unasked-for insinuations.—*Watford, Herts.* JOHN GARNE.

UTILISATION OF SMALL COAL.—At a recent meeting of the Massachusetts Institute of Technology, Dr. James D. Whelpley read a valuable and interesting paper upon a new form of furnace, especially applicable to the burning of small coal, erected by Messrs. Whelpley and Storer, of South Boston. The experiments proved, to the satisfaction of those who witnessed them, that with properly constructed and managed furnaces the poorest, most sulphurous, and earthy varieties of waste coal and shales, even those containing only 60 per cent. of carbon, can be burned as thoroughly and completely, after fine pulverisation, as the best selected coals of England and Pennsylvania, and with equally good effects, measured by the quantity of pure carbon contained in them. Solid and dust fuels seemed at first to give the same results, but the effect of the pulverisation rose gradually to the enormous difference of 44 per cent. over solid fuel, when equal quantities were put in competition. The only explanation of this gain is to be found in the employment of extended radiation from solid particles in place of convection by gases. The efficiency of a mass of particles as an agent of radiation is inversely as its diameter. It is stated that among the effects of fine reduction upon fuels the extraordinary length and volume of the flames generated is one of the most noticeable. A jet of coal dust and air 4 in. in diameter, driven into a hollow brick chamber with a velocity of 6000 ft. in a minute, will create a flame 3 or 4 ft. in diameter, and from 20 to 30 ft. long. These long flames are probably caused by the repeated formation, decomposition, and reproduction of carbonic acid. Minute particles of carbon float the entire length of the flame, and serve at once to generate and to decompose the gas, producing a continued flame.

RATEABLE VALUE OF LAND.—In the case of the Talargoch Mining Company *v.* the Guardians of St. Asaph Union, the company were in exclusive possession of an artificial watercourse, used to convey water for the purpose of the mine—a lead mine. The question was whether the company were liable to be rated for land over which the water flowed, and if so, whether to the amount of the agricultural value of the land, or to the amount of its enhanced value by reason of its being converted into a watercourse, and applied to the purposes of the mine. The Court of Queen's Bench held that they were rateable not at the agricultural value of the land, but at its enhanced value due to the capacity for conveying water.

FRAUDULENT TRANSFER OF SHARES.—In *re* the Bahu and San Francisco Railway Company, certain shares in the company were, by means of a forged document, transferred to third parties, and the transfer was registered by the company, who gave to those parties a certificate that they were the registered holders of the shares. The name of the original holder having, under section 35 of the 25 and 26 Vict., c. 89, been restored to the register as the rightful owner of the shares, it was held by the Court of Queen's Bench that the company were responsible for their registers and the certificate they gave to holders of shares. The giving of these certificates was for the advantage of the company, as it increased the facility of transfer, and the negociability and value of the shares. The certificate represented the holder to be entitled to the shares, and it was given with the intention that the holder should so represent himself. The claimant paid his money on having a transfer executed and the certificate handed to him, and the company were stopped from denying the facts so represented to him, and upon the faith of which he was induced to part with his money. He was entitled to be put in the same position as if the transfer had been valid, and as he could not have the shares, he was entitled to the value of them at the time he was struck off the register.

SHAREHOLDERS' LIABILITY.—The Articles of Association of the Anglo-Danubian Steam Navigation Company provided that the directors might reject any transfer on giving notice, within seven days of their receiving it, of their intention to do so; but that they should be bound to register every transfer as to which no such notice was given. In *re* Walker, a shareholder had executed, in pursuance of an agreement with the company, a transfer of his shares to one of the directors, and left the deed of transfer with the solicitor of the company. In the proceedings of the board was a minute of the meeting next after the transfer was executed, to the effect that the transfer had been made. The transfer was never registered, and the shareholder, during the two years which followed prior to the winding-up order, took no steps to procure registration. The question was whether, under these circumstances, he was liable as a contributary to the company. The Master of the Rolls held that he was. "You cannot (said his lordship) after this lapse of time, say that because you as well as the company have been in the wrong you are entitled to alter the position of the share register after the winding-up order. If so, how long is it to go on? If might go on for any number of years, and the object of the Act would be defeated, which is to make the register conclusive as to shareholders."

PUDDLING FURNACES AND PUDDLING.

The various kinds of furnaces at present attracting the attention of ironmasters were referred to in the paper, briefly noticed in last week's Journal, read before the Cleveland Institute of Engineers, by Mr. J. JONES, manager to Messrs. Fox, Head, and Co. The object of his paper was to explain the merits of the furnace of which he is a joint patentee, as compared with those of other inventors, and he has certainly succeeded in proving that, notwithstanding the large amount of money being wasted at Newport and elsewhere upon patented curiosities, there is no arrangement which offers any substantial improvement as compared with the puddling furnace as it existed when Mr. SAMUEL BALDWYN ROGERS had perfected his magnificent iron bottom. The common furnace is slightly wasteful in fuel, and in that respect must be improved; but against this one bad feature it has very many advantages. The first cost of the common furnace is not excessive, the surface of radiation being rendered as small as possible. It has a plain square grate, an easy method of firing, and easily removed bars. Combustion takes place close to the heating chamber or hearth. It takes but a few hours to light it up and prepare it for use, and it works, in Mr. Jones's opinion, to as good a yield of iron as any other furnace that has ever been constructed. The comparison, then, must only be made between the patented contrivances for which practical puddlers entertain so great an abhorence, owing to the loss it entails upon them until their worthlessness is proved. Mr. Jones refers to Siemens' gas puddling furnace as entitled to the first place amongst the inventions of this class, the rotary furnace of Mr. Menelaus, the Wilson furnace, and the Newport furnace coming next in the order of importance, the partisans of each of which, as Mr. Jones observes, declare that their pet has no equal.

The SIEMENS FURNACE has been well received by the scientific public, but what will always be an obstacle in the way of this furnace being adopted is its great first cost. This hindrance may not be a fatal one under circumstances where a new plant is being laid down, but it will always stand in the way if it becomes a question of removing the whole of an existing plant in order to make room for a plant of totally different construction. The object of a puddling furnace is the production of the largest yield in iron, with the least consumption of fuel. Mr. Siemens claims to do this by first generating gases, the bulk of which are carbonated hydrogen and carbonic oxide, in a gas produced from coal. The gas resulting from this is conveyed up a vertical shaft, then in an horizontal direction, and then down, ere it is taken to the regenerators, whence it is brought to the combustion chamber. The object of the vertical shaft and conduction of it, as described, is to cause to cool and condense, and thus to form a pressure, though a slight one. The gas furnace has many advantages, such, for instance, as the production of few ashes and little smoke. The forge is kept clean, and may be presentable at all times. Then, by its power of regulating the admission of gases and air, it has control over the action of the furnace. This gives it a regular and consecutive temperature. Again, the temperature may be elevated, or it may be depressed, with perfect ease and regularity; and in that respect it is much superior to the usual method of firing—the filling in of coals at intervals in a rude and primitive manner, and cooling the furnace considerably whilst such is being done. Mr. Jones observes that much has been said about the Siemens furnace having a non-oxidising flame, but he had noticed that Bessemer rail blooms heated in a Siemens furnace were covered with a thick scale of oxide of iron. Again, in the Martin process of making steel in a Siemens furnace he asks—If a non-oxidising flame exist in the Siemens furnace, how comes it that the silicon in the pig or cast iron is oxidised, and rises to the surface in a slag? What other oxidising agent is there present? It is not by the aid of free oxygen? The distinguishing feature of a Siemens furnace over other gas furnaces is the means by which the temperature of the air and gases is raised so high as 1000° and above. This is done by his regenerators—a simple and efficient way of utilising the waste heat of the furnace. The immense temperature which Mr. Siemens raises in his steel furnace is principally, if not entirely, due to these regenarators. The separation of the gas producer from the point of combustion, whilst producing some benefit, such as condensation and pressure, is clearly a loss, inasmuch as it requires heat to generate the gases, and these are by the distance allowed to cool ere they are superheated in the regenerators.

Allusion is next made to the MENELAUS FURNACE, which Mr. Jones describes as an interesting one, but one that up to the present time has been a complete failure. It is understood, he says, that the most formidable obstacle to its success arises from the want of a suitable lining, one that will not yield to the action of the molten metal, as well as one that, in mechanical action of the metal, will disintegrate. Should such a lining be found, it is more than doubtful if Cleveland pig could be used in the furnace. If good iron is required from this district pig, it is absolutely necessary to fettle with pure oxides of iron—that is, oxides of iron free from sulphur and phosphorus. It forms the bath of cinder in which the iron is cleansed of its phosphorus, and any lining that had not that effect would cause the iron to be turned out rotten and cold short. But should that furnace ever be made so that it will work, it is not clear that the cinder could be freely eliminated from the inner parts of such a large mass of iron. There does not seem to be any special attempt at the saving of fuel in the construction of the rotary furnace.

Concerning the WILSON FURNACE, Mr. Jones expresses an equally unfavorable opinion, attributing the apparent advantages attending its use to the fact of the fettling employed having been exceptionally rich in oxide of iron. Mr. Jones observed that the Wilson furnace had hitherto been chiefly remarkable for its many failures, but it was now somewhat more successful under the superintendence of Mr. Whitwell, whom, however, he feared had been in a measure misled by the generous enthusiasm which most men feel for a pet thing or subject; but, unfortunately, enthusiasm will not take the place of facts, and this is especially the case with regard to puddling furnaces. The statements to which he refered are that all points are provided for in this furnace, the gases only take up enough air to burn them properly, the action of the damper secured the good yield, whilst the large generator provided a constant supply of gas. The advantages of the furnaces he declared to be, that it would make more puddled bars out of a given quantity of metal than any other furnace, it would, owing to its conditions, make a better and more regular quality than any other furnace, as it never burned the iron, and never worked rash, and it would use less fettling, and there would be less repairs, whilst in consumption of fuel it had no equal. Now, although there is a good deal of vagueness about these statements, they were unquestionably bold. Firstly, "The gases only take up enough air to burn them properly." He presumed that what Mr. Whitwell means by this is, that only the theoretical quantity of air necessary for complete combustion with the gases is admitted. Now, Mr. Whitwell surely cannot be serious in making this statement. He had shown that in a gas furnace where the control over the gases and air is complete, that double the theoretical quantity of air is necessary; and it is so, of course, in the Wilson furnace. The air for combustion in the Wilson furnace is admitted above the fuel, and very little through the grate, and therein lies the danger of an oxidising flame. Secondly, "It would make more puddled bars out of a given quantity of metal than any other furnace." Now, the quantities he took down at the time he heard this statement are these—pig-iron consumed, 20 cwt. 2 qrs. 6 lbs., 20 cwt. 3 qrs. 2 lbs., and 20 cwt. 3 qrs. 13 lbs., in three instances, to produce 20 cwt. of bars, the consumption of coal being 17 cwt., 17 cwt. 0 qrs. 11 lbs., and 18 cwt. respectively, to the ton of bars.

Now, if you take the metallic iron in pig-iron at 93 per cent., and in puddled bar at 99¼ (and here is a loss of 6¼ per cent.), or, in other words, it would take 21 cwt. 1 qr. 9 lbs. of pig-iron to produce a ton of bars (this is independently of the action of the silicon in the pig, which by combining with iron would cause a further loss), if there were absolutely no loss by oxidation during the process of puddling. Yet Mr. Whitwell made a ton of bars from 20 cwt. 2 qrs. 6 lbs. of pig; and this was, he said, because he used a Wilson furnace. Mr. Whitwell was asked at the time what fettling he had used; and it had subsequently been ascertained that the fettling used was rich in iron. If the question were asked—Will the Wilson furnace work to a better yield than any other furnace? Mr. Jones would say emphatically "No;" and that the probabilities are, that owing to its irregularity and treacherousness at one time, and glowing with warmth at another time (difficult to understand), that the yield in an ordinary furnace would be the better. At what part in the operation of puddling does loss of iron by oxidation take place? It is not in the early stage where the silica is attacked, nor in the secondary stage during the process of elimination of carbon; but it is in the third stage, when it is ready to ball, or is being balled—the iron having by this time been almost denuded of its carbon, is eager and ready to combine with oxygen, and form cinder. There is no danger of any loss of iron in consequence of free oxygen being present until the silica and carbon are first oxidised. Well during the process of balling, the puddler invariably puts down his damper to prevent as much air getting in as possible, which would cut away his iron, and if he is but a skilful puddler he will work with a loss of no more than 28 lbs. to the ton of bars—that is, the puddler can make a ton of bars from 21 cwt. 2 qrs. 9 lbs. of pig-iron without being beholden to any reduced iron that may be deposited from the fettling.

For the NEWPORT FURNACE Mr. Jones claims that its great principle is to allow no cold air to be used for combustion. The air is heated in cast-iron pipes, placed contiguous to the uptake to a temperature between 400° and 500°, and is brought under the grate, and a small portion over the fuel. The air is heated entirely by the waste heat of the furnace. A light pressure is induced by aid of a small steam-jet. This light pressure has a beneficial effect in the furnace, inasmuch as it tends to keep the cold air from creeping in at every crevice. They still retain the old grate bar, and in that respect the furnace is defective, but they are about making a change in that direction. In the application of the Newport principle to a double furnace at work at Messrs. Whitham's, at Leeds, they use an oscillating grate bar, a double puddling-machine, the charge is 15 cwts. of pig-iron, a double-flued boiler is attached, and at the end of that are heating pipes to collect the waste steam. Mr. Jones considers it probable that this furnace will work to a lower consumption of fuel than any furnace that has ever been constructed. The yield of iron will not be so good as compared with single furnaces, owing to the cutting draught between the two doors, and the longer time required to ball up such a mass of iron, but the saving in other respects will more than compensate for this disadvantage. In conclusion, Mr. Jones expressed the opinion that it is opposed to economy to melt pig-iron in a puddling furnace. The bulk of the coal which is consumed is required to melt the iron, which is done in such a clumsy apparatus. When the pig is being decarbonised, or on the boil, it requires little or no firing, there being plenty of fuel at that stage in the pig. The iron should first be melted in an air furnace or cupola, and then run into the furnace in order that it may be puddled.

MINING IN NEVADA, U.S.

[From our Correspondent.]

Developments in the Morey district, 85 miles south-east of Austin, are being made with the most satisfactory results. The incline of the American Eagle ledge is down 91 ft. About 50 ft. from the surface one drift has been run to the west 200 ft., and another to the east 100 ft., showing a pay streak varying from 10 in. to 4 ft. thick. As proved by several lots, of 20 or 30 tons each, worked at the old Dominion mill, at Hot Creek, the ore yields at the rate of $180 to $220 per ton. The Magnolia lode is opened to the depth of 85 ft., with drifts 20 ft. each way along its course. This ledge is from 20 in. to 3 ft. thick, and yields a grade of ore ranging from $170 to $260 per ton. There have been several crushings from this claim, proving its value beyond question. An assay of the dust taken from a 2-ft. drill hole in the ore at the bottom of the incline gave the large return $1020 per ton. In the district there is much ore extracted which will give a good mill working, but as the nearest reduction works are 50 miles off nothing can be done with it at present. Morey is well provided with mining timbers and firewood, the hills around being thickly covered with nut-pine of large size, there being also sufficient water for extensive mining operations.

The Timoke Mine, at Austin, is still producing large quantities of fine ore. Some 25 or 30 tons were lately worked, giving a mill assay of $300 per ton; the most of it was rich, heavy, ruby mineral, and many remarkably fine cabinet specimens could be selected from the pile. The incline is now down 400 ft. There has been a slight break in the vein, but it is now passed, and a very rich body of ore is coming in. The last mill-working from the mine before the above was 37 tons, which averaged $309 per ton. After the cost of milling was deducted, the amount received by the company was $7997 in coin, being at the rate of $256 per ton nett. For the month of April a monthly dividend of 5 per cent. on the capital stock was remitted to the office of the company in Boston, and a similar dividend for May is now ready. This is the best kind of testimony which can be offered as proof of the value of a mine.

The assay office attached to the Manhattan mill melted and assayed 25,000 ozs. of crude bullion, it being the production of that mill for the week ending May 23. For the week ending May 16, the Manhattan mill produced 31,363 ozs. of crude bullion. This return is from a 20-stamp mill, which tells well for its efficiency and management, no less than for the high quality of the ore reduced. Nearly the whole of the ore which produced these ounces of silver was custom, and comprised many little lots from Lander Hill. In the meantime the North Star Mine is yielding large quantities of valuable ore, which is allowed to accumulate, while the mill is doing work for customers. Pleasant Valley district, in East White Pine, is destined to soon become famous for its production of rich silver ore. Quite a number of locations have been made in this district, the two principal of which are the Hidden Treasure and the Aurora claims, which are both being at present developed; the former comprise 1000 feet in length. A depth of 14 feet has been reached upon this location, and the ledge at that depth is found to be 16 ft. wide, and is a mass of mineral throughout of the richest character, yielding upon an average $300 per ton as far as tested. It crops above the ground for a distance of over 400 feet. Several tons of the ore have been sent to Austin and reduced, which yielded largely, and many tons of like quality are lying upon the surface, to which more is added daily, awaiting the time when it can be reduced near by. A team or two, however, will be kept constantly employed in hauling the richest of it to Austin, a distance of more than 100 miles, to enable the owners to pay the expenses of development. The Aurora is situated about three-fourths of a mile south of the Hidden Treasure, and the ore is identical. A shaft has been sunk 14 ft., and a cut about 20 ft. long made across the ledge, with a view of determining its thickness, but this distance has failed to reach the opposite wall of this monster vein. These works, though superficial, have disclosed an immense amount of ore, much of which is of high grade. Many tons can be selected from the mass which will yield an average of $400 to $500 per ton. This being the case it cannot be long before capital is attracted thither, mills built convenient to these mines, and the ore reduced on the ground. The Monte Christo Mill, a small five-stamp affair, is situated 20 miles westward from the Pleasant Valley Mines. Natural facilities are not wanting in that section, there being plenty of wood, water, grass, and agricultural lands, besides the incomparable mineral veins.

AN IMMENSELY VALUABLE MINE.—The Eureka Mine, now regarded as the most valuable gold mine in Nevada county, and perhaps is the most valuable in the world, is situated a mile and a quarter north-east of the town of Grass Valley, and was located early in 1851. It was worked at intervals, by various parties, up to 1857, but the most of the rock failed to pay for crushing. In the latter year it was purchased by Messrs. Fricot, Ripert, and Pralus, and the first crushing made by them; the rock being taken from near the surface yielded only $4 a ton. From 1857 to 1863 the mine was worked to a perpendicular depth of 50 ft., during which a large quantity of quartz was taken out, none of which paid largely, and the greater portion failed to pay expenses. Becoming satisfied, at length, that the mine was a good one, they sank a vertical shaft in 1863 to the depth of 100 feet, and the mine has since been yielding handsome returns. On the 1st of October, 1865, the mine was sold to a company of capitalists for $400,000 in gold coin. How much it had yielded up to that time is not known, but the owners erected hoisting works and a 20-stamp mill, all at a cost of $60,000, besides receiving large dividends from the profits. The mine has been producing, under the present management, at the rate of about $40,000 a month. In the first year, ending September 30, 1866, the gross product was $531,431, and for the 11 months ending August 31, 1867, $588,139, making a total of $1,119,570 in 23 months. Nearly a thousand tons of rock have been taken from the mine every month and reduced at the mill, the average yield being not far from $50 a ton; and the monthly expenses, including repairs to machinery and permanent improvements, have averaged about $16,000. The regular monthly dividends for over a year past have amounted to over $30,000, and one or two extra dividends have been declared in addition. The Eureka Mine is opened by an incline shaft, 5 by 20 feet, which is designed to explore the vein to a great depth, and is now down nearly 500 feet. Levels have been run from the shaft at distances of 100 ft. apart, and for 700 ft. along the lode. At 50 ft. from the surface the quartz paid $15 a ton, and increased to $28 at 100 feet. Between the 100 and 200 feet levels the average yield was $37 a ton, and below that the average has been $50. The vein runs nearly east and west, dipping south at an angle of about 78°; and over the whole extent of some 700 feet which has been worked, the average width is 3 feet. At the fourth level the mine is said to show still further improvement, with an increase in the yield of ore, though it has been worked but little below the third level. The value of the mine, with the mill, hoisting works, and other property connected therewith, is now rated at about $1,000,000. William Watt, a successful quartz miner, and one of the owners of the Eureka, is the superintendent.—*American Journal of Mining.*

PREVENTING INCRUSTATION IN STEAM-BOILERS.—Mr. C. W. HARRISON, of Oberstein-road, Clapham, has provisionally specified an invention which consists in connecting the shell of the boiler with another body in opposite electrical polarity. One method by which he effects this object is by suspending a metal plate in the boiler and attaching it to the shell of the boiler, so that the two shall constitue a galvanic combination. He so proportions the size of the two that the electro-chemical action on the interior surface shall be nascent, or nearly so; and he finds it merely necessary under ordinary circumstances to impart a positive polarity to the shell of the boiler, in order to prevent the coherence thereto of precipitated matters.

LONDON GENERAL OMNIBUS COMPANY.—The traffic receipts for the week ending June 21 amounted to 12,599*l.* 12*s.* 4*d.*

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